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None

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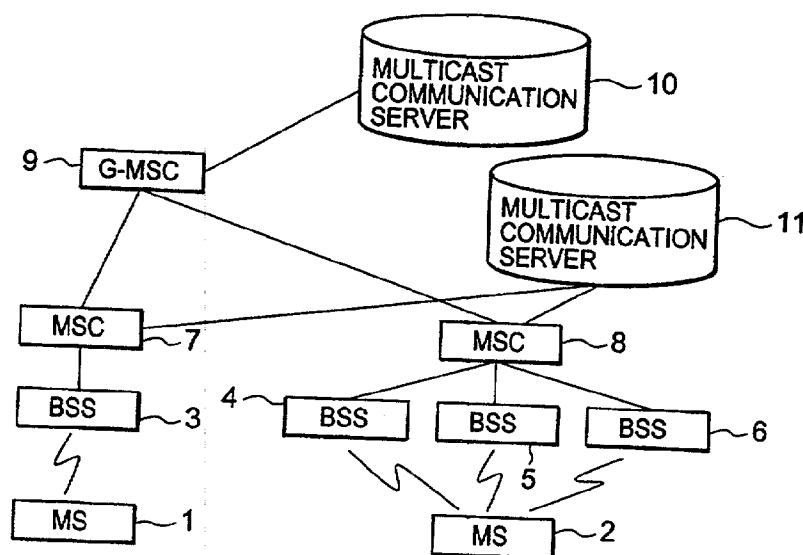
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(54) Abstract Title

A multicast communication method for a CDMA mobile communication system

(57) A CDMA communication system comprises mobile subscribers 1, 2, anchor and branch base stations 3-6 connected to mobile switching centres 7 and 8 which are in turn connected to a gateway mobile switching centre 9 and multicast communication servers 10, 11. A multicast request is sent to at least one anchor station along with area information details. The start and content of multicast information distribution are notified to the mobile subscribers via a broadcast channel. The spreading code to be used may also be transmitted. Multicast information is then transmitted from the anchor and branch stations according to the received area information and after a time delay.

Fig.1



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Fig.1

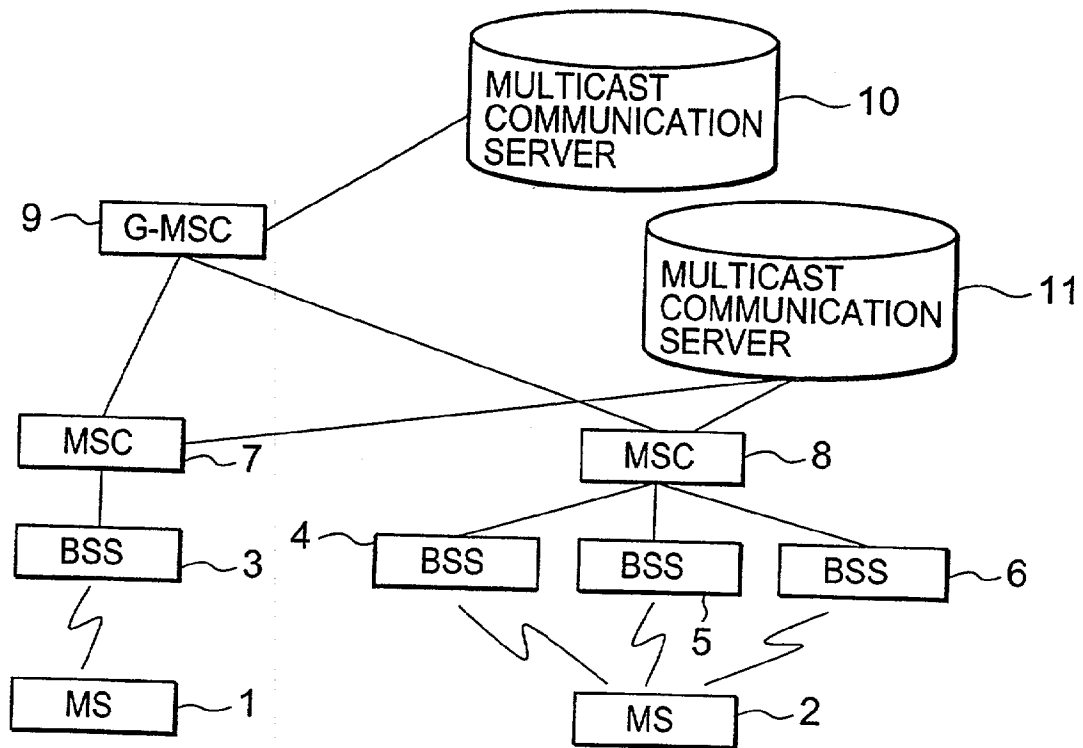


Fig.2

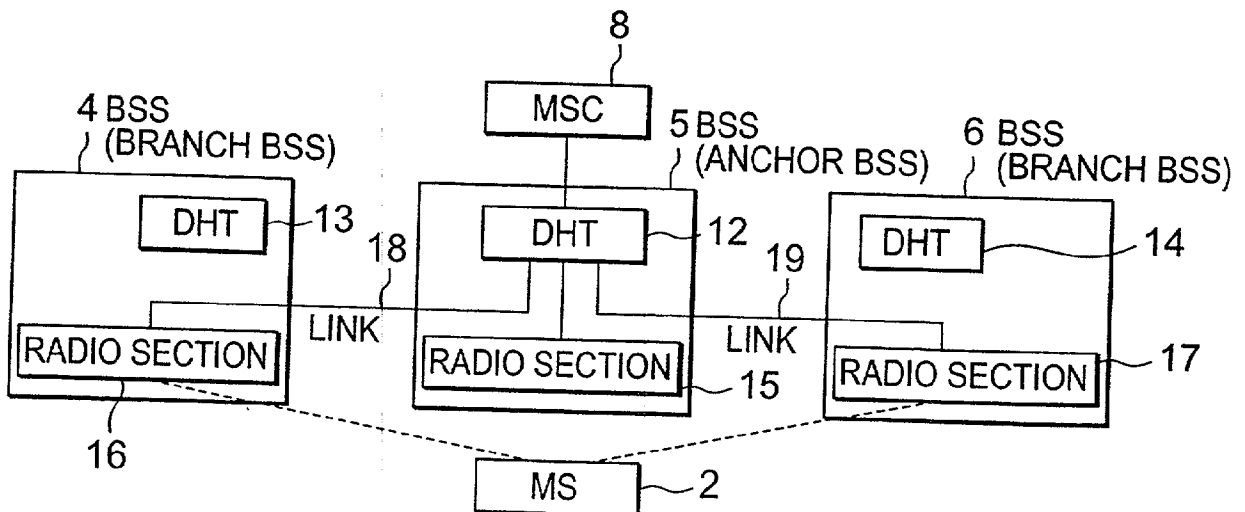


Fig.3

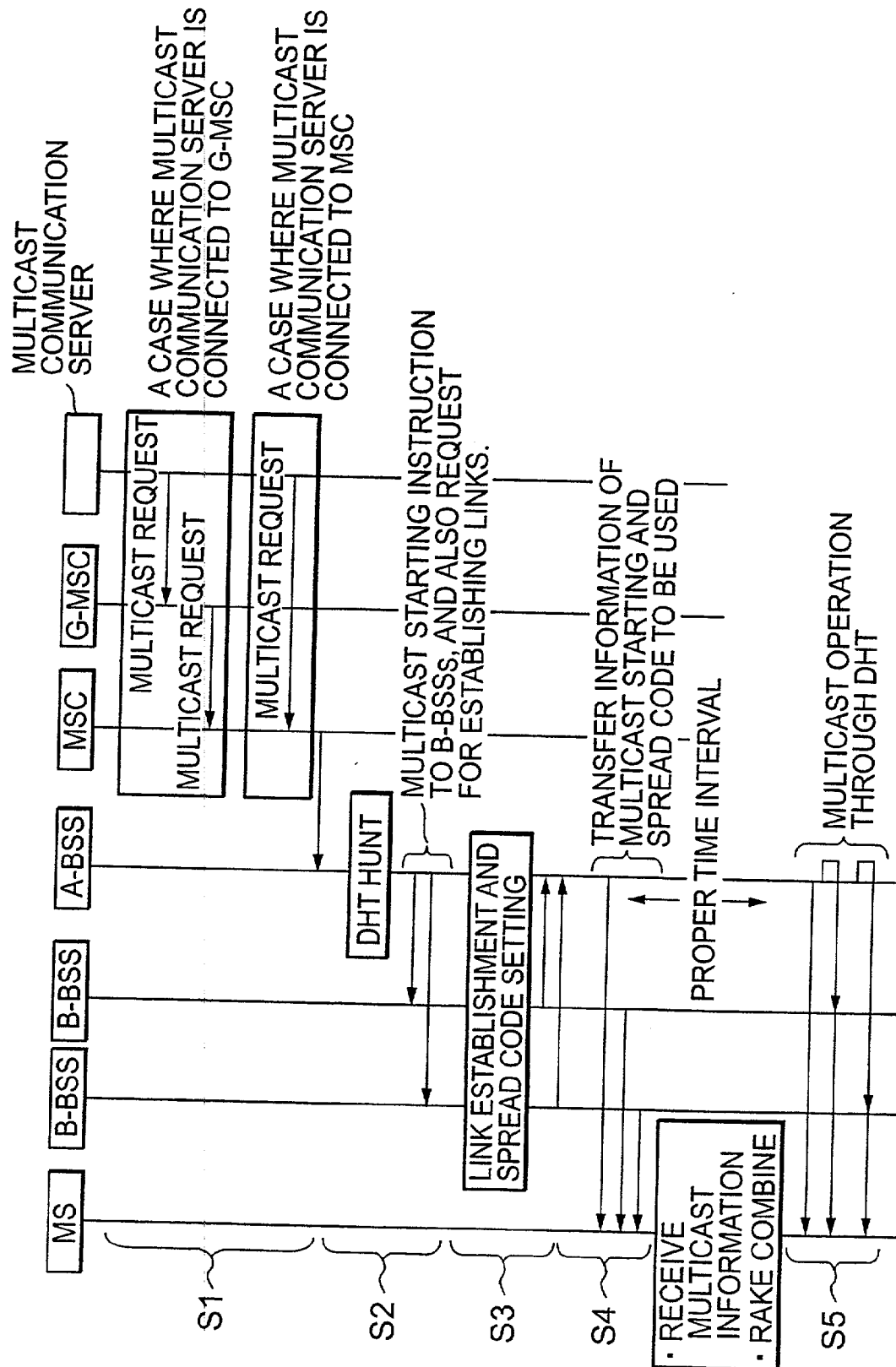
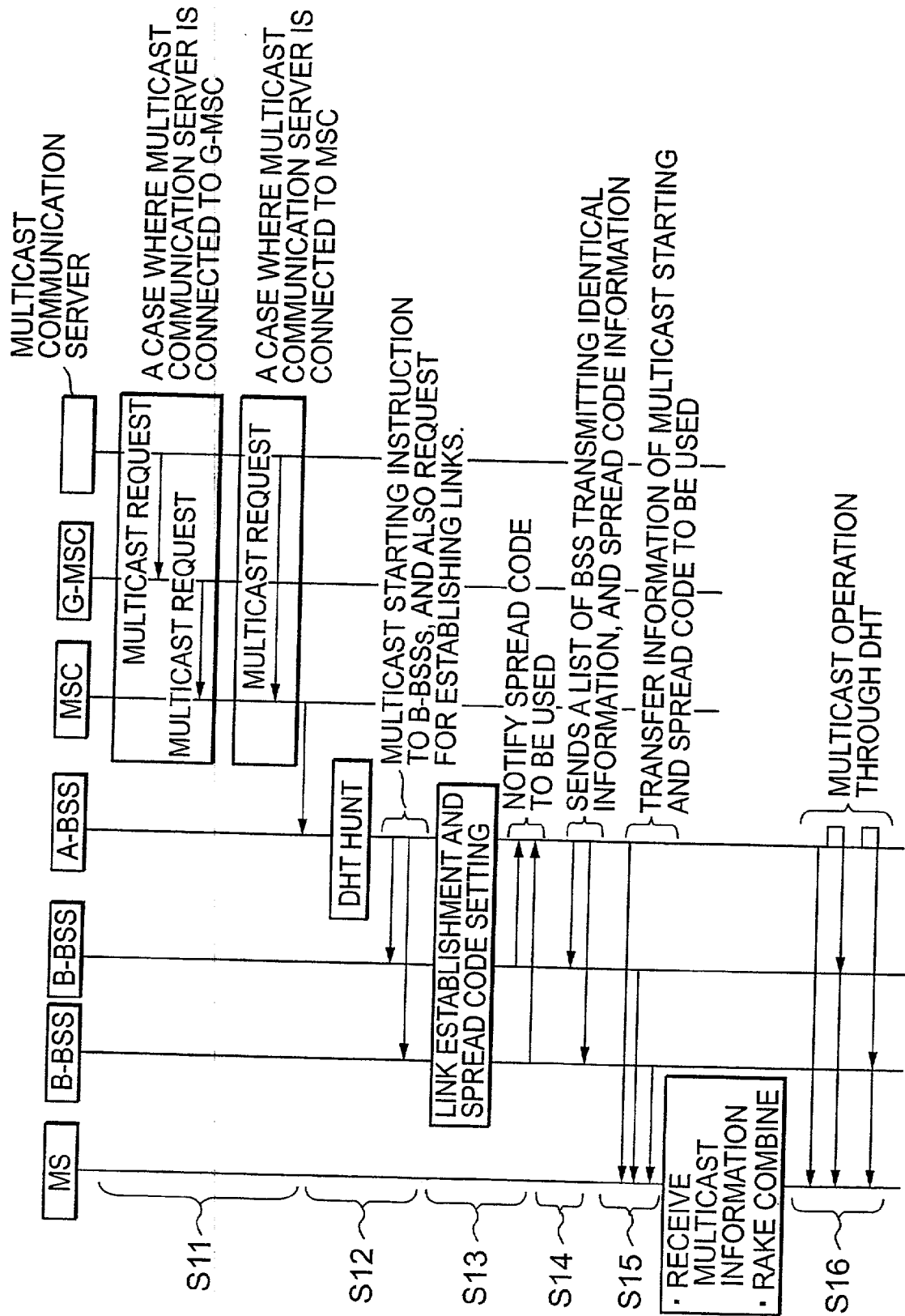


Fig.4



A MULTICAST COMMUNICATION METHOD FOR A CDMA MOBILE COMMUNICATION SYSTEM

The present invention relates to a multicast communication method to be performed in a CDMA (Code Division Multiple Access) mobile communication system.

A previously proposed multicast communication method for use in a
5 CDMA mobile communication system was disclosed in the specification of Japanese Laid-Open Patent Hei 10 (1998)-107770 in which service negotiations for the multicast communication are performed in a calling procedure between a mobile subscriber (abbreviated as MS, hereinafter) and a base station system (abbreviated as BSS, hereinafter) the MS
10 obtaining a spread code which is used for each multicast communication method.

Alternatively, in a plurality of BSS's, it has been proposed that each multicast service data be transmitted by using a broadcast channel of each BSS without any linkage between them.

15 However, the following problems exist in the previously proposed multicast communication method for use in a CDMA mobile communication system.

(1) Regarding a system in which a spread code is allocated for each multicast communication method by service negotiations in a calling
20 procedure between the MS and the BSS, since a registration operation for the spread code is executed for each multicast service at the MS that receives information, processing becomes complex. Thus, the system is not suitable for the multicast communication method of advertising use in which information is simultaneously transmitted to a large number of MS's. In
25 addition, since the spread code must be fixed for each multicast communication method to be notified, dynamic use of a limited number of spread codes is not allowed. Thus, this system lacks efficiency.

(2) Regarding a system in which each multicast communication data is transmitted by each BSS by using respective broadcast channels, since the position of the MS cannot be specified when a multicast operation is performed, the transmission power in each BSS must be set to a maximum in order to enable a possible MS located in the vicinity of a boundary to receive a signal sent from the BSS. But if a data signal is transmitted by an output more than necessary, noise is generated in other MS's. Consequently, the capacity of the entire system is reduced.

Arrangements to be described below, by way of example in illustration of the present invention enable a multicast communication method to be provided for use in a CDMA mobile communication system, which is capable of reducing transmission power in a BSS and perform an efficient multicast operation for a large number of MS's.

A particular multicast communication method for use in a CDMA mobile communication system to be described below by way of example in illustration of the present invention includes a plurality of mobile subscribers, a plurality of base station systems connected to the mobile subscribers by radio channels, a plurality of mobile switching centres connected to the base station systems and a multicast communication server connected to the mobile switching centres for providing information to be distributed to the mobile subscribers, each of the base station systems transmits information which is necessary for enabling the mobile subscriber to receive the multicast information through respective broadcast channels to each of the mobile subscribers before the multicast information is transmitted.

The particular method includes

(1) sending a multicast request to at least one anchor base station system together with area information for multicasting;

(2) instructing a multicast request from the anchor base station system to at least one branch base station system necessary for covering multicasting area indicated by the area information;

(3) transmitting multicast starting information and spread code to be used for multicasting information to mobile subscribers through respective broadcast channels of the anchor base station system and the branch base station system; and

- 5 (4) transmitting multicasting information from the anchor base station system and the branch base station system after a proper time interval, during which the mobile subscribers have been made ready for receiving multicasting information, has elapsed.

In the multicast communication method set forth above, the anchor
10 base station system may use a diversity hand-over trunk for establishing links to the branch base station systems.

The multicast communication method set forth above may further include receiving multicasting information, at the mobile subscriber, transmitted from a plurality of base station systems, and performing a RAKE
15 combine process for respective received signals.

In another arrangement, the method includes:

- (1) sending a multicast request to at least one anchor base station system together with area information for multicasting;
- (2) instructing a multicast request and link establishment request
20 from the anchor base station system to at least one branch base station system necessary for covering a multicasting area indicated by the area information;
- (3) sending back information of link establishment completion and information of a decided spread code for multicasting information at each
25 base station system to the anchor base station system from the branch base station system;
- (4) transmitting multicast starting information together with a list

indicating base station systems transmitting identical multicasting information and spread code to be used for multicasting information to mobile subscribers through respective broadcast channels of the anchor base station system and the branch base station system; and

- 5 (5) transmitting multicasting information from the anchor base station system and the branch base station system after a proper time interval, during which the mobile subscribers have been made ready for receiving multicasting information, has elapsed.

The multicast communication method in a CDMA mobile
10 communication system set forth above, may further include:

- 6) detecting, at the mobile subscriber, receivable base station systems listed in the list transmitted through the broadcast channel, and preparing the reception of multicasting information by setting spread codes indicated in the list; and
- 15 (7) receiving multicasting information, at the mobile subscriber, transmitted from a plurality of base station systems, and performing a RAKE combine process for respective received signals.

Arrangements and methods of operation for multicast communication in a CDMA mobile communication system will now be
20 described by way of example with reference to the accompanying drawings in which:-

Fig. 1 is a diagrammatic representation of the relationship between base station systems and mobile subscribers,

Fig. 2 is a block schematic diagram for use in describing one
25 particular arrangement,

Fig. 3 is a schematic diagram partly in flowchart form for use in describing one method of operation of the communication system shown in

Figs. 1 and 2, and

Fig. 4 is a schematic diagram, partly in flowchart form for use in describing another method of operation of the communication system shown in Figs. 1 and 2.

5 Referring to Fig. 1, there are shown a plurality of mobile subscribers (MS's 1 and 2), base station systems (BSS's 3 to 6) connected to the MS's 1 and 2 by radio channels for playing main roles of information multicasting to the MS's 1 and 2, mobile switching centres (MSC's 7 and 8) connected to the BSS 3 and also connected to the BSS's 4 to 6 for processing calls
10 originated from the MS's 1 and 2 or calls incoming thereto, updating location information of the MS's 1 and 2, a gateway mobile switching centre (G-MSC 9) connected to the MSC's 7 and 8 for performing connections to other networks, a multicast communication server 10 connected to the G-MSC 9, and also another multicast communication server 11 connected
15 to the MSC's 7 and 8. Radio connections between the MS1 and the BSS 3, and between the MS2 to the BSS's 4 to 6 are respectively established by a mobile communication procedure using the CDMA system.

The multicast communication servers 10 and 11 store contents information of multicast services, area information of each multicast service
20 as a destination for multicasting information, and time for multicasting information. Timers are installed inside a server. These timers are set for each stored information, and by the timers, time for starting multicasting the stored information can be detected. Further, a service identifier is set for each multicast service so as to enable distributed information to be identified
25 in the MS's 1 and 2.

Fig. 2 shows a specific example of the arrangement of Fig. 1 which includes the MS2, the BSS's 4 to 6 and the MSC 8 shown in Fig. 1.

As shown in Fig. 2, BSS's are classified into an anchor BSS 5 for playing main roles of information multicasting, and branch BSS's 4 and 6 for subordinately contributing to information multicasting by means of a link connection between each branch BSS and the anchor BSS 5. The anchor
 5 BSS 5 and branch BSS's 4 and 6 are connected to each other by links 18 and 19.

Functional sharing between the anchor BSS and the branch BSS's may be different for each multicast information. Also, even for identical information, functional sharing may be different for each multicasting
 10 information, for example between day and night.

The BSS's 4 to 6 respectively include diversity hand-over trunk (DHT) 12 to 14 provided to perform a soft hand-over operation in the CDMA system, and radio sections 15 to 17 provided to perform radio signal transmission and reception processing, and signal modulation and
 15 demodulation. The soft hand-over operation is one of unique features of the CDMA system. As the CDMA system uses the same frequency for radio communication, a MS can establish a plurality of radio channels to a plurality of BSS's as long as radio signal condition is good for each BSS. Therefore, as for the reverse channel signal, the BSS 5 can receive signal from the MS
 20 not only via the radio section 15 of its own BSS, but also via the radio section 16 of the BSS 4 and the radio section 17 of the BSS 6, and the strongest signal is selected as the received signal at the DHT 12 in the BSS 5.

The area information to be transmitted, which has been stored in
 25 the multicast communication servers 10 and 11, contains bits of information regarding which BSS should be set as an anchor BSS and which BSS should be set as a branch BSS. The area information may be different for

each multicasting information. For G-MSC 9 and MSC's 7 and 8, a different BSS configuration may be specified each time a multicast transmission request is transmitted. For example, even for identical multicast information, area information different between day and night may be specified

5 In order to perform communications between BSS's 3 to 6 and MS's 1 and 2, the mobile communication system includes a broadcast channel provided to simultaneously to provide system information or the like to a plurality of MS's, and a traffic channel provided to transmit specific data mainly to respective MS. MS's 1 and 2 include means provided to enable
10 individual broadcast channel reception to be performed.

Next, a multicast communication method in the mobile communication system configured in the foregoing manner will be described.

Fig. 3 shows a flowchart for use in describing one multicast
15 communication method of operation of the CDMA mobile communication system shown in Figs. 1 and 2.

First, in the multicast communication server 10 or 11, when a time comes to transmit accumulated data, information to be transmitted is notified together with area information to be transmitted to G-MSC 9 or MSC's 7 and
20 8, and a request is made to perform a multicast operation (step S1). Here, if G-MSC 9 receives a request transmitted from the multicast communication server 10 or 11, the request is transferred to MSC's 7 and 8 corresponding to the requested area information. In G-MSC 9, this request is copied when necessary, and transferred to a plurality of MSC's.

25 On the other hand, if MSC's 7 and 8 receive a request transmitted from the multicast communication server 10 or 11, the request is transferred

to the anchor BSS's 3 and 5 corresponding to the requested area information. In the MSC's 7 and 8, this request is copied when necessary, and transferred to a plurality of anchor BSS's.

Upon having received the request transferred from the MSC 8, the anchor BSS 5 hunts the DHT 12 for a multicast operation, and informs the starting of information transmission to surrounding branch BSS's 4 and 6 corresponding to the area for information transmission. Then, links 18 and 19 are established for transmission of the notified information between branch BSS's 4 and 6 (step S2).

Then, in the branch BSS's 4 and 6, information necessary for transmitting information regarding a spread code or the like at the time of information transmission is selected and decided (step S3). A spread code may be different not only for performing a multicast operation for different information, but also for transmitting identical information at a different time.

Then, in each of BSS's 4 to 6, the starting of information transmission by the multicast operation is notified through the broadcast channel to subordinate MS 2 (step S4). At this time, identification information indicating the selected spread code, information for deriving the spread code or the spread code itself is simultaneously notified. Also, information other than the spread code, which is necessary for data reception by the MS 2, is notified.

After the starting of the multicast operation has been notified to the MS 2, with an appropriate time interval, data is transmitted from the anchor BSS 5 through the DHT 12 to the branch BSS's 4 and 6. Subsequently, in a branch BSS that has received the data transmitted from the BSS 5, a multicast operation is performed by using the pre-selected and decided spread code (step S5).

In the MS's 1 and 2, the broadcast channel has been received for receiving the paging of an incoming call during waiting or system information. Upon having received the starting of the multicast operation through the broadcast channel, in the MS's 1 and 2, the identification
5 information indicating the spread code, the information for deriving the spread code or the spread code itself used for information transmission is received through the broadcast channel of the same BSS.

If the identification information indicating the spread code or the information for deriving the spread code is received, based on the
10 information, the spread code is introduced, and setting is made for data reception based on the spread code. Also, information other than the spread code, which is necessary for data reception, is received.

In the MS's 1 and 2, after the starting of the multicast operation has been recognized based on the information received through the broadcast
15 channel, in order to detect whether the same information is transmitted from surrounding BSS's, a receiving operation is also performed for the notified information transmitted from another BSS. If the transmission of the same information from another BSS is recognized, then setting is made for data reception by the same procedure.

20 If MS can receive data from a plurality of BSS's, setting is made for performing the RAKE combine.

Fig. 4 illustrates a flowchart of another arrangement for use in describing a multicast communication method of operation of the CDMA mobile communication system shown in Figs. 1 and 2.

25 First, in the multicast communication server 10 or 11, when a time comes to transmit accumulated data, information to be transmitted is notified

together with area information to be transmitted to the G-MSC 9 or the MSC's 7 and 8, and a request is made to perform a multicast operation (step S11). Here, if the G-MSC 9 receives a request transmitted from the multicast communication server 10 or 11, the request is transferred to the
5 MSC's 7 and 8 corresponding to the requested area information. In the G-MSC 9, this request is copied when necessary, and transferred to a plurality of MSC's.

On the other hand, if the MSC's 7 and 8 receive a request transmitted from the multicast communication server 10 or 11, the request is
10 transferred to the anchor BSSs 3 and 5 corresponding to the requested area information. In the MSC's 7 and 8, this request is copied when necessary, and transferred to a plurality of anchor BSS's.

Upon having received the request transferred from the MSC 8, the anchor BSS 5 hunts the DHT 12 for a multicast operation, and informs the
15 starting of information transmission to surrounding branch BSS's 4 and 6 corresponding to the area for information transmission. Then, links 18 and 19 are established for transmission of the notified information between branch BSSs 4 and 6 (step S12).

Subsequently, in the branch BSS's 4 and 6, information necessary
20 for transmitting information regarding a spread code or the like at the time of information transmission is selected and decided, and transmitted to the anchor BSS 5 (step S13). A spread code may be different not only for performing a multicast operation for different information, but also for transmitting identical information at a different time. Then, in the anchor BSS
25 5, the information transmitted from the branch BSS's 4 and 6 is combined with the information for data transmission, such as the spread code selected

and set in the anchor BSS 5. Then, a list of BSS to which identical information is transmitted, and a list of information regarding the spread code or the like used by each BSS, are made, and notified to the branch BSS's 4 and 6 (step S14).

- 5 In the branch BSS's 4 and 6, when the starting of the multicast operation is notified, the list of BSS to which identical data is transmitted and the list of information regarding the spread code or the like used by BSS are also notified simultaneously, these lists having been received from the anchor BSS 5. Also, in the anchor BSS 5, when the starting of the multicast
10 operation is notified, the list of BSS to which identical data is transmitted and the list of information regarding the spread code or the like used by BSS are simultaneously notified (step S15).

- After the information transmitted from the BSS's 4 to 6 have been received, in the MS 2, detection is made as to existence of receivable BSS
15 in the list of BSS to which received identical data is transmitted. If receivable BSS exists, then the information regarding the spread code or the like used by BSS, which has been received beforehand, is used, and setting is made to receive data from a plurality of BSS's.

- With a proper time interval from processing in step S15, in the anchor
20 BSS 5, data is transmitted through the DHT 12 to the branch BSS's 4 and 6. Then, in the BSS that has received the above data, a multicast operation is performed for the data by using the setting of pre-selected and decided spread code or the like (step S16).

- Because of the foregoing configuration, the arrangements described
25 are effective in the following respects.

- (1) Signals transmitted from a plurality of base station systems can be

combined by performing the RAKE combine in a subscriber's mobile located in the vicinity of the boundary of the cell. Accordingly, even if transmission power is set low in one base station system, a signal strength after RAKE combining in the subscriber's mobile can be kept high. Thus, transmission power can be reduced in the base station system that performs a multicast operation.

(2) A multicast operation can be performed without any complex procedures such as a calling operation. A multicast operation can be efficiently performed for a large number of mobile subscribers.

It will be understood that although particular arrangements have been described in illustration of the invention, by way of example, variations and modifications thereof, as well as other arrangements may be conceived within the scope of the appended claims.

CLAIMS

1. A multicast communication method for use in a CDMA mobile communication system, in which the system includes a plurality of mobile subscribers, a plurality of base station systems connected to the mobile subscribers by radio channels, a plurality of mobile switching centres connected to the base station systems and a multicast communication server connected to the mobile switching centres for providing information to be distributed to the mobile subscribers, and the method includes sending a multicast request to at least one anchor base station system together with area information for multicasting, instructing a multicast request from the anchor base station system to at least one branch base station system necessary for covering a multicasting area indicated by the area information, transmitting multicast starting information and a spread code to be used for multicasting information to mobile subscribers through respective broadcast channels of the anchor base station system and the branch base station system, and transmitting multicasting information from the anchor base station system and the branch base station system after a proper time interval, during which the mobile subscribers have been made ready for receiving the multicasting information, has elapsed.
2. A multicast communication method for use in a CDMA mobile communication system as claimed in claim 1, wherein the anchor base station system uses a diversity hand-over trunk for establishing links to the branch base station systems.
3. A multicast communication method for use in a CDMA mobile communication system as claimed in claim 1, wherein the method includes

receiving at the mobile subscriber multicasting information transmitted from a plurality of base station systems, and performing a RAKE combine process for respective received signals.

4. A multicast communication method for use in a CDMA mobile communication system, in which the system includes a plurality of mobile subscribers, a plurality of base station systems connected to the mobile subscribers by radio channels, a plurality of mobile switching centres connected to the base station systems and a multicast communication server connected to the mobile switching centres for providing information to be distributed to the mobile subscribers, and the method includes sending a multicast request to at least one anchor base station system together with area information for multicasting, instructing a multicast request and link establishment request from the anchor base station system to at least one branch base station system necessary for covering a multicasting area indicated by the area information, sending back information concerning link establishment completion and information concerning a decided spread code for multicasting information at each base station system to the anchor base station system from the branch base station system, transmitting multicast starting information together with a list indicating base station systems transmitting identical multicasting information and a spread code to be used for multicasting information to mobile subscribers through respective broadcast channels of the anchor base station system and the branch base station system, and transmitting multicasting information from the anchor base station system and the branch base station system after a proper time interval, during which the mobile subscribers have been made ready for receiving multicasting information, has elapsed.

5. A multicast communication method for use in a CDMA mobile communication system as claimed in claim 4, wherein the anchor base station system uses a diversity hand-over trunk for establishing links to the branch base station systems.
- 5 6. A multicast communication method for use in a CDMA mobile communication system as claimed in claim 4, wherein the method includes detecting, at the mobile subscriber, receivable base station systems listed in the list transmitted through the broadcast channel, and preparing for the reception of multicasting information by setting spread codes indicated in
10 the list, and receiving at the mobile subscriber multicasting information transmitted from a plurality of base station systems, and performing a RAKE combine process for respective received signals.
7. A multicast communication method as claimed in claim 1 or claim 4 substantially as described herein with reference to Figs. 1 and 2 and Fig. 3
15 or Fig. 4 respectively of the accompanying drawings.



Application No: GB 9928972.0
Claims searched: 1 to 7

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Examiner: Glyn Hughes
Date of search: 30 May 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H4L (LDGX)

Int Cl (Ed.7): H04Q 7/22

Other: Online: WPI, JAPIO, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	NONE	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.